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INSTRUCTION MANUAL

EMR MODEL 4580
HIGH-FREQUENCY
VOLTAGE-CONTROLLED OSCILLATOR
(REVISION C)

(SERIAL NO. 39 AND UP)

SANGAMO WESTON
Schlumberger
EMR TELEMETRY

ME-7623

C

C.1

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EMR
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July, 1970

MANUAL CHANGE NOTICE #1

EFFECTIVITY

EMR Model 4581 VCO Card Assembly (Assy. No. 15913) for serial numbers 39 through 63 and 65 and up of the Model 4580 High-Frequency Voltage-Controlled Oscillator.

CHANGE

The types and/or values were changed for diode CR1 and resistors R27 and R52, and resistor R94 was added to the VCO printed-wiring board assembly (Assy. No. 15913). The manual areas affected by this change are Figure 5-4 and Table 6-3 as follows:

CR1 -- DIODE, Zener, 10V ±5%; EMR STOCK NO. 088-10-47401; MFGR. CODE JEDEC; MFGR. PART NO. 1N4740A.

R27 -- RESISTOR, 1K ±5%, 1/2W; EMR STOCK NO. 622-02-10000; MFGR. CODE 01121; MFGR. PART NO. RC07GF102J.

R52 & R94 -- RESISTOR, 100 ohms ±5%, 1/2W; EMR STOCK NO. 622-02-10009; MFGR. CODE 01121; MFGR. PART NO. RC07GF101J.

EMR MODEL 4580

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Total number of pages in this manual is 48 consisting of the following:

Page No.	Rev. Letter
*Title	C
i thru iii	Basic
1-1 thru 1-4	Basic
*2-1 and 2-2	C
2-3	B
3-1 and 3-2	Basic
*3-3	C
3-4 and 3-5	Basic
4-1	Basic
*4-2	C
4-3 and 4-4	Basic
5-1 thru 5-10	Basic
*5-11 and 5-12	C
5-13	B
5-14	Basic
6-1 thru 6-3	Basic
*6-4 thru 6-9	C
6-10 thru 6-14	Basic

* The asterisk indicates pages that changed in the current revision.

TABLE OF CONTENTS

SECTION		PAGE
1	GENERAL DESCRIPTION	1-1
	1.1 Introduction	1-1
	1.2 Functional Description	1-1
	1.3 Physical Description	1-1
2	SPECIFICATIONS	2-1
	2.1 General	2-1
	2.2 Electrical Specifications	2-1
	2.3 Mechanical Specifications	2-2
	2.4 Environmental Specifications	2-3
	2.5 Model Number Identification	2-3
3	INSTALLATION AND OPERATION	3-1
	3.1 Installation	3-1
	3.2 Operation	3-1
	3.2.1 Operating Controls and Monitor Jacks	3-1
	3.2.2 Initial Adjustment Procedure	3-1
4	THEORY OF OPERATION	4-1
	4.1 General	4-1
	4.2 Model 4581 VCO Card Assembly	4-1
	4.3 Power Supply and Regulator Card Assembly 13680	4-3
5	MAINTENANCE	5-1
	5.1 General	5-1
	5.2 Troubleshooting	5-1
	5.2.1 Inspection	5-1
	5.2.2 Maintenance Procedures	5-2
6	REPLACEABLE PARTS LIST AND RECOMMENDED SPARES	6-1
	6.1 General	6-1
	6.2 Provisioning Considerations	6-1
	6.3 Ordering Instructions	6-2

LIST OF ILLUSTRATIONS

FIGURE		PAGE
1-1	Model 4580 Functional Block Diagram	1-2
1-2	Model 4580 Assembly Diagram	1-4
3-1	Model 4580 External Electrical Connections	3-3
3-2	Model 4580 Front Panel Controls and Test Jacks	3-4
4-1	Model 4581 VCO Card Assembly Simplified Schematic Diagram	4-2
4-2	Power Supply and Regulator Card Assembly 13680 Simplified Schematic Diagram	4-4
5-1	Power Supply and Regulator Card Assembly 13680 Component Location Diagram	5-9
5-2	Power Supply and Regulator Card Assembly 13680 Schematic Diagram	5-10
5-3	Model 4581 VCO Card (Assembly 15913) Component Location Diagram	5-11
5-4	Model 4581 VCO Card (Assembly 15913) Schematic Diagram	5-12
5-5	Model 4580 Wiring Diagram	5-13
5-6	Transistor Board Assembly	5-14

LIST OF TABLES

TABLE NO.		PAGE
3-1	Model 4580 Function of Front Panel Controls and Test Points	3-5
5-1	Power Supply and Regulator Assembly 13680 Transistor Voltage Measurements	5-3
5-2	Model 4581 VCO Card Assembly, Transistor Voltage Measurements and Waveforms	5-4
6-1	Model 4580 High-Frequency Voltage-Controlled Oscillator Parts List	6-3
6-2	Regulator Card Parts List	6-4
6-3	Model 4581 VCO Card Assembly Parts List	6-6
6-4	Manufacturers' Names and Code Numbers	6-10
6-5	Customer Provisioning Questionnaire	6-14

SECTION 1

GENERAL DESCRIPTION

1.1 INTRODUCTION

This manual contains information describing the EMR Model 4580 High-Frequency Voltage-Controlled Oscillator. Included in this information is a functional and physical description, specifications, installation and operation, theory of operation, maintenance data, and replaceable parts lists.

1.2 FUNCTIONAL DESCRIPTION

The Model 4580 is a precision solid-state device designed to modulate a carrier signal in the range of 10 KHz to 25 MHz, with an intelligence input signal from DC to 5 MHz. The unit operates from a single-ended source to generate a frequency-modulated (FM) subcarrier signal output. Each unit operates at a particular subcarrier center frequency and deviation. These parameters are established by interchangeable plug-in VCO cards. Center frequency and deviation parameters are identified on the unit front panel.

Included in the Model 4580 is an input limiter, an input amplifier, a voltage-controlled oscillator, a wave shaper, and an output amplifier. The electrical configuration for the Model 4580 is shown in the simplified block diagram, Figure 1-1.

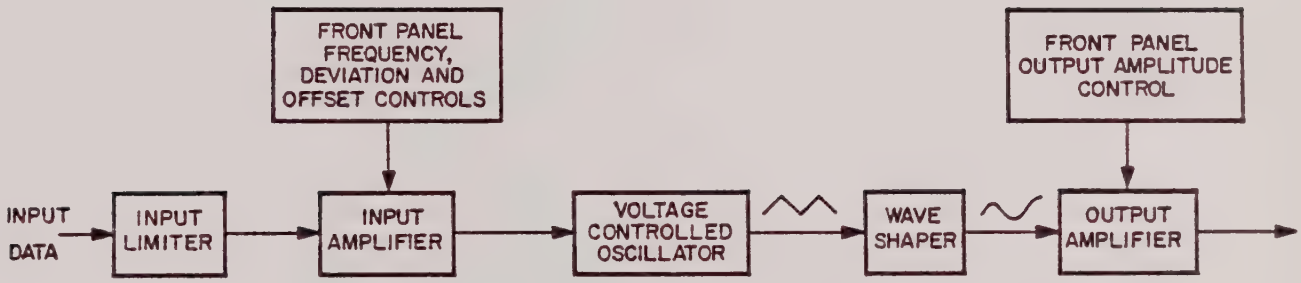
The standard Model 4580 contains an input limiter stage that enables operation from data source devices generating data signals of 5 volts peak-to-peak amplitude. (Non-standard units capable of receiving data inputs having other amplitudes are available on special order.) Front panel frequency (FREQ), deviation (DEV), and offset controls adjust the input amplifier quiescent conditions.

The Model 4580 oscillator is a triangular-wave oscillator that operates at the nominal frequency of the selected subcarrier channel. Operating frequencies within the selected subcarrier channel are controlled by the input voltage from the input amplifier. The triangular-wave output of the VCO is routed to a wave-shaper circuit that converts the signal into a sine-wave output that is amplified and routed to external equipment.

Each Model 4580 contains a power supply and regulator which operates from a primary AC power input to generate all regulated voltages required for unit operation.

1.3 PHYSICAL DESCRIPTION

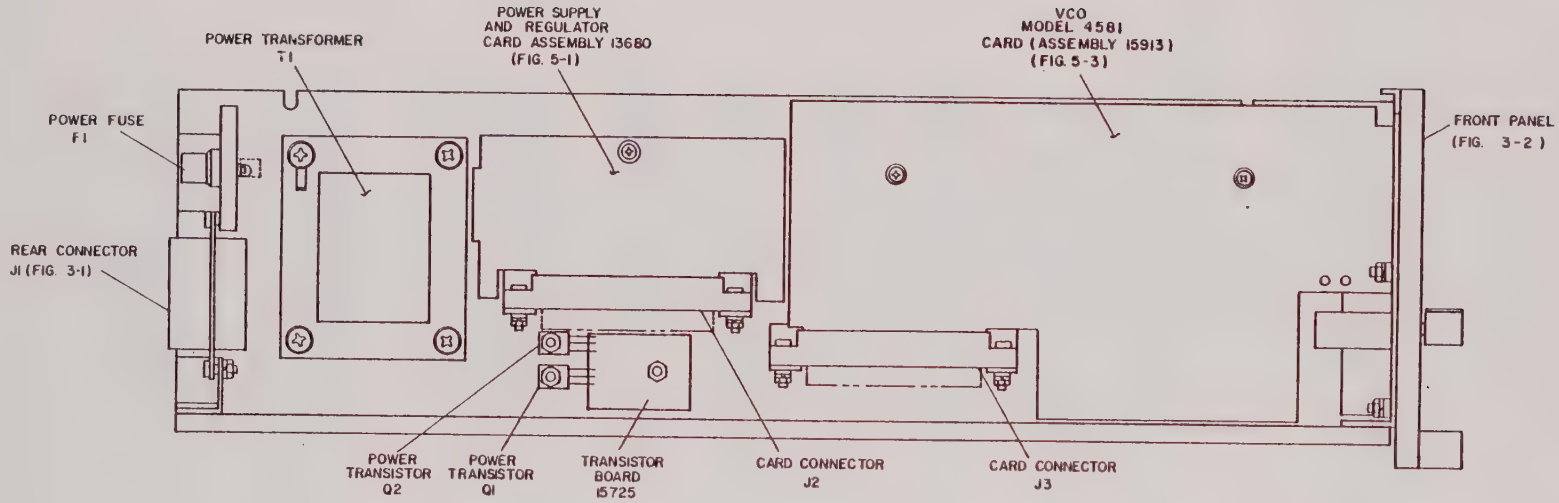
The Model 4580 is a modular unit designed for mounting in an EMR Model 4005 Rack Adapter. The rack adapter occupies 5-1/4 inches of panel height in a



NOTE: Dwg. Control No. 4580-002

Figure 1-1. Model 4580 Functional Block Diagram

standard 19-inch equipment rack. The interior of the rack adapter is divided into fourteen modular increments, each 1-7/32 inches wide. The Model 4580 occupies one modular increment in the rack adapter interior. An assembly diagram, Figure 1-2, illustrates the type and location of Model 4580 assemblies.



NOTE: Dwg. Control No. 4580-001

Figure 1-2. Model 4580 Assembly Diagram

SECTION 2

SPECIFICATIONS

2.1 GENERAL

This section contains the electrical, mechanical, and environmental specifications for the Model 4580 High-Frequency Voltage-Controlled Oscillator. Also included, is model number identification for the unit. This information is outlined in paragraphs 2.2 through 2.5.

2.2 ELECTRICAL SPECIFICATIONS

a. Input Impedance: Minimum of 1000 ohms.

b. Input Signal Amplitude: 5 volts peak-to-peak for full deviation. (Standard Model 4580 only.)

c. Input Offset: Front panel offset switch has positions for accepting zero to plus, zero to minus, or plus and minus balanced around zero input signals.

d. Intelligence Response: Flat within 3 Db from DC to 5 MHz for deviation ratios of 2 or greater.

e. Carrier Center Frequencies: 10 KHz to 24 MHz. (Maximum upper bandedge frequency is 25 MHz.)

f. Carrier Deviation: Adjustable from ±4% to ±40%. Deviation sense is positive.

g. Zero Instability: Not more than ±0.1% of center frequency for a 15-hour period after a 30-minute warmup. Drift temperature coefficient will be no more than ±0.01% of center frequency per degree Centigrade.

h. Static Nonlinearity: Not more than ±0.2% of full bandwidth BSL for deviations no more than ±20% and not more than ±0.4% of full bandwidth BSL for deviations greater than ±20%.

i. Intelligence Distortion: For deviation ratios of 2 or more and with bandedge-to-bandedge modulation, harmonic distortion will be less than 1% for any modulation frequency up to the channel cutoff.

j. Carrier Distortion: Individual harmonics of the carrier signal will be less than 2% of the fundamental amplitude.

k. Output Impedance: The output must be terminated in an impedance of 50 to 220 ohms. The multiplex output is compatible with the EMR Model 4880 Mixer Amplifier input.

l. Output Amplitude: A minimum of 2 volts peak-to-peak into a 220-ohm load or 1 volt peak-to-peak into a 50-ohm load. Output is adjustable with a potentiometer down to 0.4 volt peak-to-peak.

m. Output Current: Not more than 10 Ma peak. A short circuit at the output terminal will not damage the unit in any way.

n. Incidental FM Noise: Not more than 0.1% RMS of full bandwidth for a deviation ratio of 2 or greater.

o. Deviation Limiting: For input over voltages up to ±15 volts, the deviation is automatically limited to an equivalent input voltage of 3 ±0.5 volts either polarity. (Standard Model 4580 only.)

p. Power Source Characteristics: The Model 4580 contains its own power supply and regulators. Line voltages of 105 to 132 volts at 47 to 65 Hz, 105 to 132 volts at 360 to 440 Hz, and 207 to 253 volts at 47 to 63 Hz are available per customer order.

q. Line-Voltage Sensitivity: A 10-volt change in the line voltage within the operating range of 105 to 132 volts results in a frequency change of no more than 0.1% of full bandwidth.

2.3 MECHANICAL SPECIFICATIONS

a. Panel Size: 5-1/4 inches (13.3 Cm) high by one modular width (1.22 inches, 3.10 Cm).

b. Depth: 16-3/4 inches (42.5 Cm) from rear of subpanel to rear of chassis, excluding rear panel projections.

c. Net Weight: 3 pounds (1.4 Kg).

d. Shipping Weight: 5 pounds (2.27 Kg).

2.4 ENVIRONMENTAL SPECIFICATIONS

a. Operating Temperature Range: +10°C to +50°C to circulating air.

b. Storage Temperature Range: -55°C to +85°C.

2.5 MODEL NUMBER IDENTIFICATION

Model number identification for the Model 4580 is as follows:

Model 4580 - XX-X-XXXXXXXX-X High-Frequency Voltage-Controlled Oscillator
(a: XX; b: X; c: XXXXXXXX; d: X)

a. Design Sequence: 01 = Standard

b. Power: 0 -- 105 to 132V RMS, 47 to 65 Hz.
7 -- 105 to 132V RMS, 360 to 440 Hz.
8 -- 230V RMS, ±10%, 47 to 63 Hz.

c. Center Frequency in 8-digit kHz.

d. Panel Paint Lettering Codes: *

1 = Light Green 00048W
2 = Dark Green 00049W
4 = Gray 26492B
9 = Special Paint

*(W and B following color codes refer to White or Black lettering.)

SECTION 3

INSTALLATION AND OPERATION

3.1 INSTALLATION

The EMR Model 4580 High-Frequency Voltage-Controlled Oscillator is shipped completely assembled and is ready for mounting. The unit should be inspected immediately on its arrival and notice given to EMR-Telemetry of any claim that the product does not conform with the terms of the order.

The Model 4580 is a modular unit designed for mounting in an EMR Model 4005 Rack Adapter. The modular unit is positioned on T-rails on the bottom surface of the rack adapter interior and is inserted into the mounting location. A push-to-lock knob on the front panel is depressed securing the unit in the mounting location of the rack adapter. The unit rear connector, J1, mates with a receptacle in the rack adapter interior completing the electrical connections.

Information illustrating the position of the unit in the rack adapter and internal wiring of the rack adapter is contained in the EMR Model 4005 Rack Adapter Instruction Manual. The Model 4580 rear connector, J1, and the external connections terminated at J1 are illustrated in Figure 3-1.

Internal cooling for the Model 4580 is provided by a blower mounted vertically on the rack adapter rear panel.

3.2 OPERATION

3.2.1 Operating Controls and Monitor Jacks

The operating controls and monitor jacks used for operation of the Model 4580 are illustrated in Figure 3-2 and described in Table 3-1.

3.2.2 Initial Adjustment Procedure

Prior to operating the Model 4580, an initial adjustment procedure should be performed. All initial adjustments and switch settings are performed at front panel switches and controls. Before performing the initial adjustments, the operator should be thoroughly familiar with the function of the Model 4580 operating controls. A description of these components is contained in paragraph 3.2.1.

The initial adjustment procedures outlined in this paragraph are for the standard Model 4580. For non-standard units, any variations to the initial adjustment procedures will be covered by addendum to this manual. Perform the initial adjustment procedures for the standard unit as follows:

a. Set front panel offset switch to required input offset condition. ("−" for −5V to 0V; "0" for ±2.5V; or "+" for 0 to +5V input.)

b. With a frequency meter connected between the OUT and GRD front panel test jacks, adjust the front panel FREQ potentiometer for design center frequency using the following input voltages:

Offset Switch Position	Input Voltage
−	−2.5V DC
0	0.00V DC
+	+2.50V DC

c. With a frequency meter connected between the OUT and GRD front panel test jacks, adjust front panel DEV potentiometer for design high bandedge using the following input voltages:

Offset Switch Position	Input Voltage
−	0.00V DC
0	+2.50V DC
+	+5.00V DC

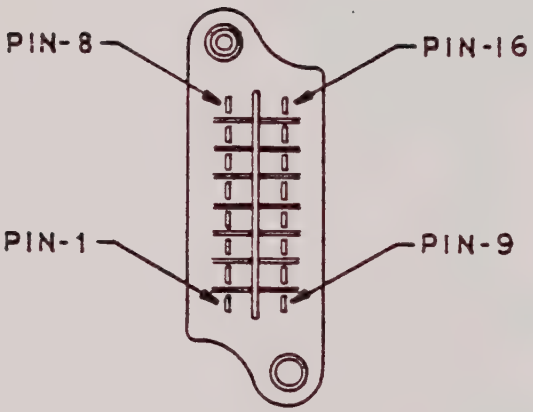
d. Repeat steps b and c as required.

e. Disconnect frequency meter from front panel test jacks and connect AC voltmeter to these test jacks.

f. Adjust front panel OUT control R21 to obtain the desired output voltage.

NOTE

The output voltage amplitude is a function of the output load. Refer to paragraph 2.2, step 1 for output capabilities.



PIN	FUNCTION
1	INPUT
2	INPUT RETURN
3	
4	
5	
6	
7	AC NEUTRAL
8	AC PHASE
9	
10	
11	
12	
13	
14	OUTPUT
15	OUTPUT RETURN
16	CHASSIS GROUND

NOTES:

1. EMR DRAWING 16266.

Figure 3-1. Model 4580 External Electrical Connections

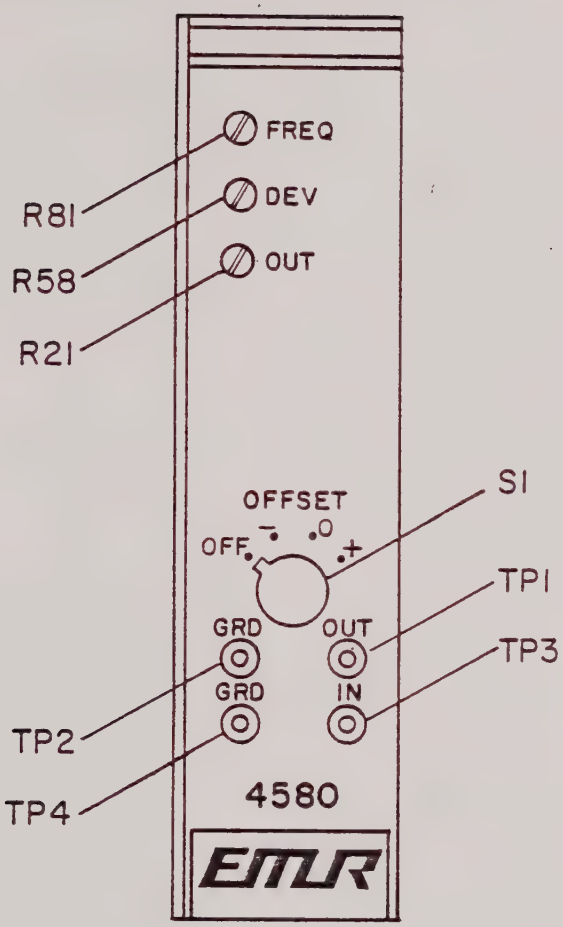


Figure 3-2. Model 4580 Front Panel Controls and Test Jacks

Table 3-1. Model 4580 Function of Front Panel Controls and Test Points

DESIG.	NAME	FUNCTION
R21	OUT potentiometer	Adjusts amplitude of Model 4580 signal output voltage.
R58	DEV potentiometer	Adjusts carrier signal deviation.
R81	FREQ potentiometer	Used in conjunction with offset switch S1, to adjust the operating frequency of the VCO.
S1	OFFSET rotary switch	Selects the initial operating zero input frequency of the VCO. In the minus (-) position, the VCO operates at upper bandedge frequency. In the zero (0) position, VCO operates at center frequency. In the plus (+) position, VCO operates at lower bandedge frequency.
TP1	OUT test jack	Monitor point for Model 4580 signal output.
TP2	GRD test jack	Output ground.
TP3	IN test jack	Monitor point for data signal input to Model 4580.
TP4	GRD test jack	Input signal ground.

SECTION 4

THEORY OF OPERATION

4.1 GENERAL

This section contains the theory of operation for the Model 4580 High-Frequency Voltage-Controlled Oscillator. Included in the theory discussion is a description of the Model 4581 VCO and the power supply and regulator circuits. These circuits are described in paragraphs 4.2 and 4.3 with reference to the appropriate schematics in Sections 4 and 5. For a general description of the Model 4580, refer to the functional description contained in Section 1, paragraph 1.2.

4.2 MODEL 4581 VCO CARD ASSEMBLY (REF. FIGURES 4-1 AND 5-4)

The VCO card assembly consists of an input over-voltage limiter stage, an input amplifier stage, a triangular wave oscillator, a wave shaper, and an output amplifier. The amplitude of the data input to the VCO is limited to 5 volts peak-to-peak by input limiter Q12-Q13. The limiter stage output is routed through emitter-follower Q14 to input amplifier Q15. At this point, the quiescent conditions of the input amplifier are established by the front panel FREQ, OFFSET and DEV controls. Amplifier Q15 output may be offset, positive or negative, by adjusting the OFFSET switch. The temperature compensation circuit compensates for frequency drift with temperature, and FREQ control R81 provides adjustment of the zero input frequency. DEV control R58 establishes the proper voltage level of the data input to amplifier Q15.

Offsetting amplifier Q15, positive or negative, selects the initial operating zero input frequency of the triangular-wave oscillator. For a (-) OFFSET, the output voltage from amplifier Q15 to the VCO corresponds to a high-bandedge frequency with zero input. Thus, the data input signals ranging from a 0-volt level to a negative level are accommodated. With a (+) OFFSET, the output voltage of amplifier Q15 corresponds to a low-bandedge frequency with zero input which accommodates data input signals ranging from a 0-volt level to a positive level. The (0) OFFSET position sets the output of amplifier Q15 at a level corresponding to center frequency with zero input, enabling operation from bipolar data input signals.

The nominal subcarrier frequency at which the triangular-wave oscillator operates is dependent upon the particular Model 4581 VCO Card Assembly installed in the unit. The available values of frequency-determining components provide a wide range of center frequencies and deviations. The operating frequency of the triangular-wave oscillator within a selected subcarrier channel is controlled by the output voltage of amplifier Q15. Depending upon the operating parameters set at the input amplifier stage, the triangular-wave oscillator may be set to operate at the subcarrier channel center frequency or a frequency corresponding to a bandedge of the subcarrier channel.

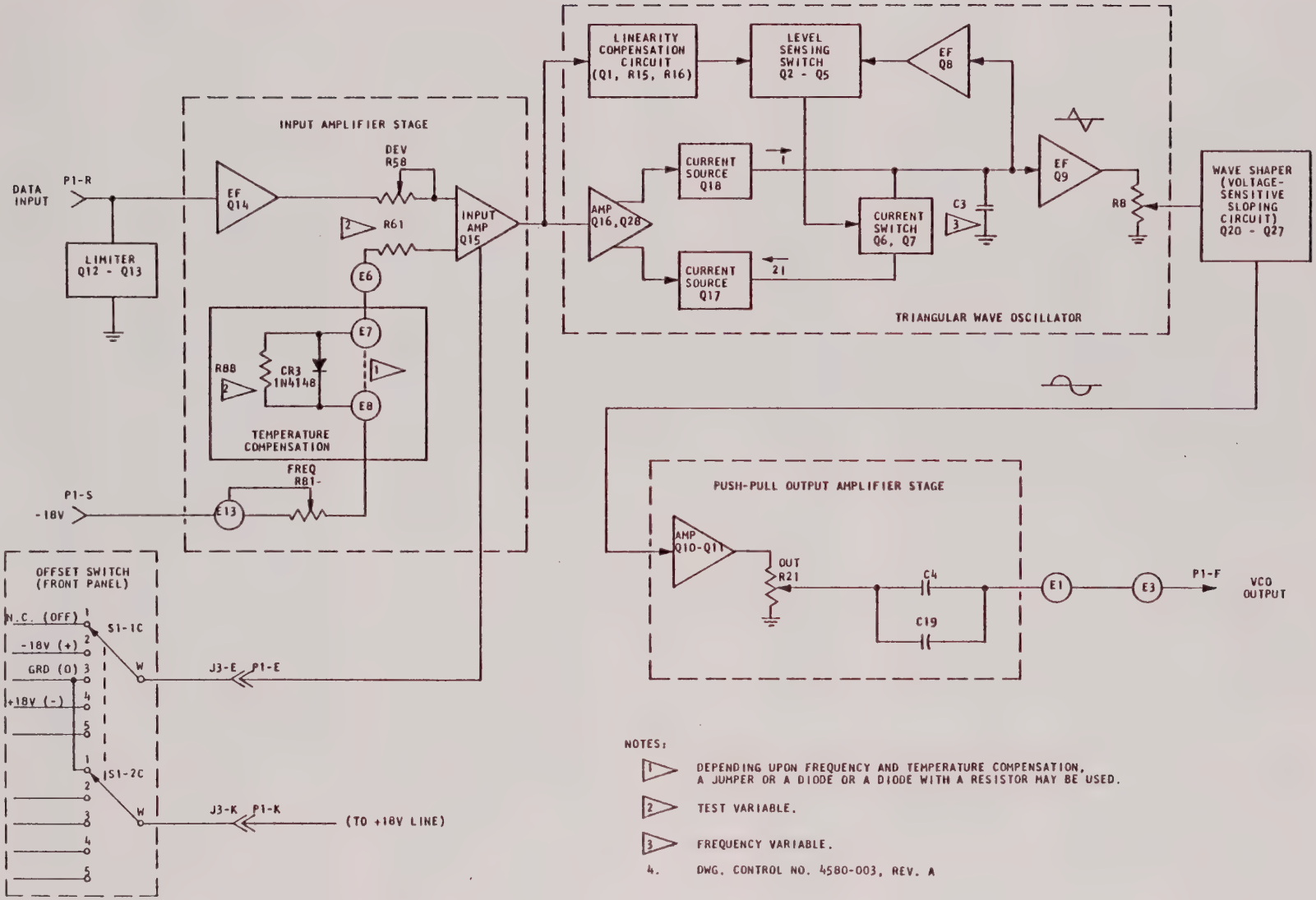


Figure 4-1. Model 4581 VCO Card Assembly Simplified Schematic Diagram

The triangular-wave oscillator is a free-running oscillator. Linear Current source Q18 charges capacitor C3 with current (+I) and the voltage ramp on C3 is monitored by level-sensing switch Q2-Q5. When capacitor C3 charges to a predetermined voltage level, the level-sensing switch turns on current switch Q6-Q7, enabling a discharge path for C3 via the current source Q17 (-2I). When the charge at capacitor C3 drops to a predetermined voltage level, level-sensing switch Q2-Q5 turns off current switch Q6-Q7 and current source Q18 again begins charging C3. The linearity compensation circuit maintains the peak amplitudes (positive and negative) of the triangular-wave oscillator output at constant levels by compensating for the finite switching times of the circuits.

The output of the triangular-wave oscillator is routed to waveshaper circuit Q20-Q27. The waveshaper is a voltage-sensitive sloping circuit that converts the output of the triangular-wave oscillator into a sine-wave output by performing a sloping function at points on the positive and negative going edges of the waveform.

The resulting sine-wave output is amplified in push-pull amplifier Q10-Q11 and AC coupled to pin F of card connector P1. OUT potentiometer R21 provides output signal adjustment from 2.0 to 0.4 volt peak-to-peak into an open circuit or 1.0 to 0.2 volt peak-to-peak into a 50-ohm load.

4.3 POWER SUPPLY AND REGULATOR CARD ASSEMBLY 13680 (REF. FIGURES 4-2 AND 5-2)

The power supply and regulator card circuits, together with chassis-mounted transformer T1 and series regulator transistors Q1 and Q2, operate from the primary AC power input and generate the required DC operating voltages for the Model 4580. The AC power input at pin 8 of rear connector J1 is routed to transformer T1 through input fuse F1 which provides overload protection for the power supply circuits. Two secondary windings of T1 are connected across dual full-wave diode rectifier assemblies CR1 and CR7. These rectifiers provide unregulated DC voltages to the positive and negative voltage regulator circuits.

Regulation in the plus regulator, consisting of card transistors Q1 through Q3 and chassis-mounted transistor Q1, is accomplished by comparing a sample of the output voltage with a voltage reference established by zener diode CR4. A differential amplifier consisting of transistors Q2 and Q3 senses the magnitude and polarity of any output voltage change and produces an output that is proportionally equal and opposite to the error detected. The error controls the biasing of series regulator driver stage Q1 which in turn controls the biasing of chassis-mounted series regulator transistor Q1.

Regulation in the minus regulator consisting of card transistors Q4 through Q6 and chassis-mounted transistor Q2 is accomplished in an identical manner as that described for the plus regulator.

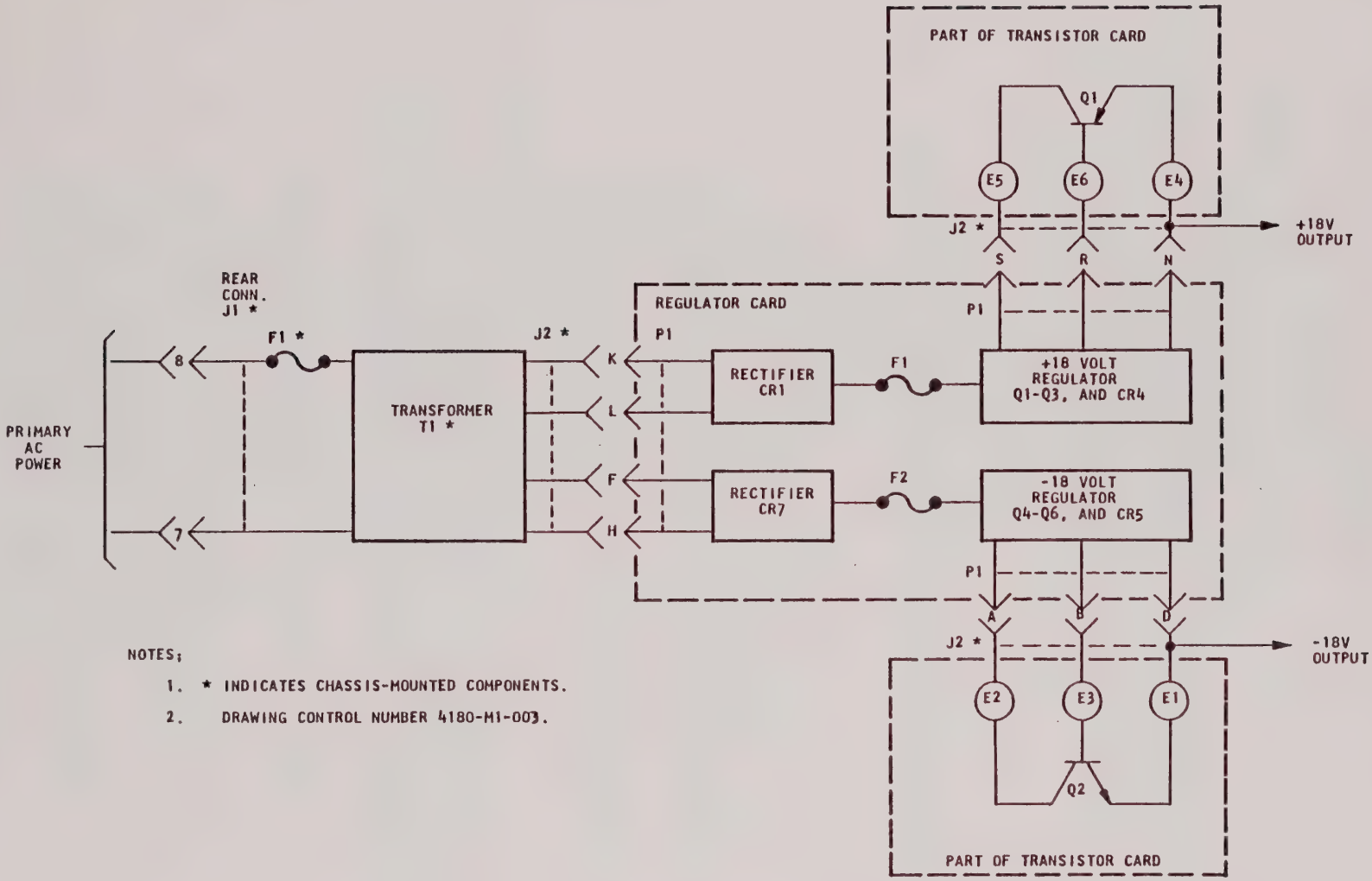


Figure 4-2. Power Supply and Regulator Card Assembly 13680
Simplified Schematic Diagram

SECTION 5

MAINTENANCE

5.1 GENERAL

This section contains information to aid in troubleshooting and maintaining the EMR Model 4580 High-Frequency Voltage-Controlled Oscillator. This information is intended for use in conjunction with the theory of operation, contained in Section 4, so that maintenance may be performed with maximum efficiency. Included in the maintenance information is a troubleshooting guide and assembly and schematic diagrams of the Model 4580 assemblies.

5.2 TROUBLESHOOTING

In the event an abnormal condition is detected in the unit operation, the following general method of isolating and repairing the trouble is recommended:

a. Perform visual inspection (paragraph 5.2.1).

b. Perform maintenance procedures (paragraph 5.2.2).

c. When defective component is located, refer to Section 6, Parts List, for replacement component information.

d. Recheck affected circuit to ascertain that the malfunction is repaired.

5.2.1 Inspection

The Model 4580 should be subjected to a regular inspection program similar to that recommended for other types of electronic equipment. The inspection program should be performed periodically as a means of preventive maintenance or, if a malfunction occurs, to aid in isolating trouble. The inspection guide is as follows:

a. Inspect front-and rear-panel components for signs of damage.

b. Inspect wiring for loose or broken connection.

c. Inspect printed-circuit cards for mechanical damage or component discoloration.

d. Inspect printed-circuit-card connectors and mating chassis receptacles for signs of damage.

5.2.2 Maintenance Procedures

The Model 4580 is a precision solid-state unit designed for long component life. However, should a malfunction occur, transistor or integrated-circuit module replacement may repair a majority of the troubles. To isolate a defective circuit, refer to the simplified schematic diagrams contained in Section 4. These diagrams illustrate the prime signal flow paths and significant components of the unit. Systematic tracing of signal flow and checking DC voltages should result in locating a defective component or circuit. If a defective component is located, refer to the appropriate parts list table in Section 6 for component replacement information. However, if a defective circuit is located, refer to the appropriate step below for further aids in isolating a defective component.

a. Power Supply and Regulator: The DC voltage outputs for the power supply and regulator are as follows:

1. Pin D -- —18 volts ±100 millivolts

2. Pin N -- +18 volts ±100 millivolts

If these voltages are not as stated, troubleshoot power supply and regulator using typical voltages supplied in Table 5-1. To locate specific chassis-mounted components (power transistors Q1, Q2 and transformer T1) and components mounted on the power supply and regulator card, refer to Figure 1-2 and 5-1.

b. VCO Card Assembly: Isolation of a defective component on this card is accomplished by referring to the table of transistor voltage measurements (Table 5-2), schematic diagram (Figure 5-4) and component location diagram (Figure 5-3). It should be noted that the indications provided in Table 5-2 are typical for all VCO cards and that actual indications for a particular unit may vary. However, in a malfunctioning circuit, the indications will differ significantly from those provided in Table 5-2.

CAUTION

Before removing Model 4581 VCO Card Assembly, unplug pin jacks J1 and J2 from card. Failure to do this can result in damage to unit.

Table 5-1. Power Supply and Regulator Assembly 13680
Transistor Voltage Measurements

TRANSISTOR	EMITTER	BASE	COLLECTOR
Q1	+24 to +33	+23.4 to +32.4	+18.6
Q2	+8.4	+9.0	+23.4 to +32.4
Q3	+8.4	+9.0	+18.0
Q4	-8.4	-9.0	-23.4 to -32.4
Q5	-8.4	-9.0	-18.0
Q6	-24 to -33	-23.4 to -32.4	-18.6
CHASSIS MOUNTED REGULATOR COMPONENTS			
Q1	-18	-18.6	-24 to -33
Q2	+18	+18.6	+24 to +33

NOTE:

1. Voltages taken during normal operation.
2. Use oscilloscope for voltage measurements.

Table 5-2. Model 4581 VCO Card Assembly,
Transistor Voltage Measurements and Waveforms

COMPONENT	PIN OR ELEMENT	VOLTAGE AND WAVEFORM
		NOTES
		1. Measurements in the above table (Table 5-2) were made using 5.2 MHz ±400 KHz unit.
		2. Measurements made under the following conditions:
		a. Input shorted to input common.
		b. Open-circuit output.
		c. Front panel controls set as follows:
		OFFSET switch set to 0. FREQ control set for 5.2 MHz (f_o). DEV control set for ±400 KHz. OUT set for maximum output.
Q1	E	10.7V
	B	11.4V
	C	17.5V
Q2	E	0V -2V
	B	+1V -1V
	C	+6V +4V
Q3	E	-0.5V -1.2V
	B	0V -2V
	C	(Same as Q2 collector)

Table 5-2 (Cont'd.). Model 4581 VCO Card Assembly, Transistor Voltage Measurements and Waveforms

COMPONENT	PIN OR ELEMENT	VOLTAGE AND WAVEFORM
Q4	E	(Same as Q3 emitter)
	B	+0.5V -2V
	C	+6.5V +3.5V
Q5	E	+0.5V -2V
	B	+1V -1.5V
	C	(Same as Q4 collector)
Q6	E	0V -2V
	B	(Same as Q5 base)
	C	+7.2V
Q7	E	(Same as Q6 emitter)
	B	+1V -1V
	C	+5.4V +3V
Q8	E	+4.4V +2.3V
	B	(Same as Q7 collector)
	C	(Same as Q6 collector)
Q9	E	+6V +4V

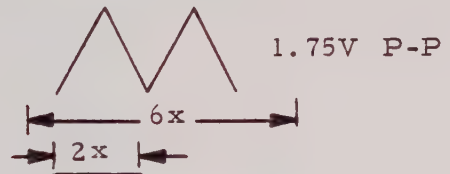
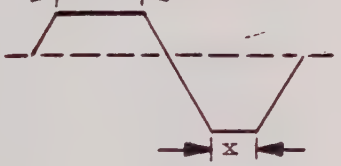
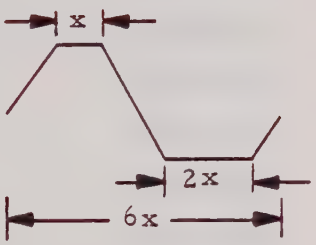
Table 5-2 (Cont'd.). Model 4581 VCO Card Assembly, Transistor Voltage Measurements and Waveforms

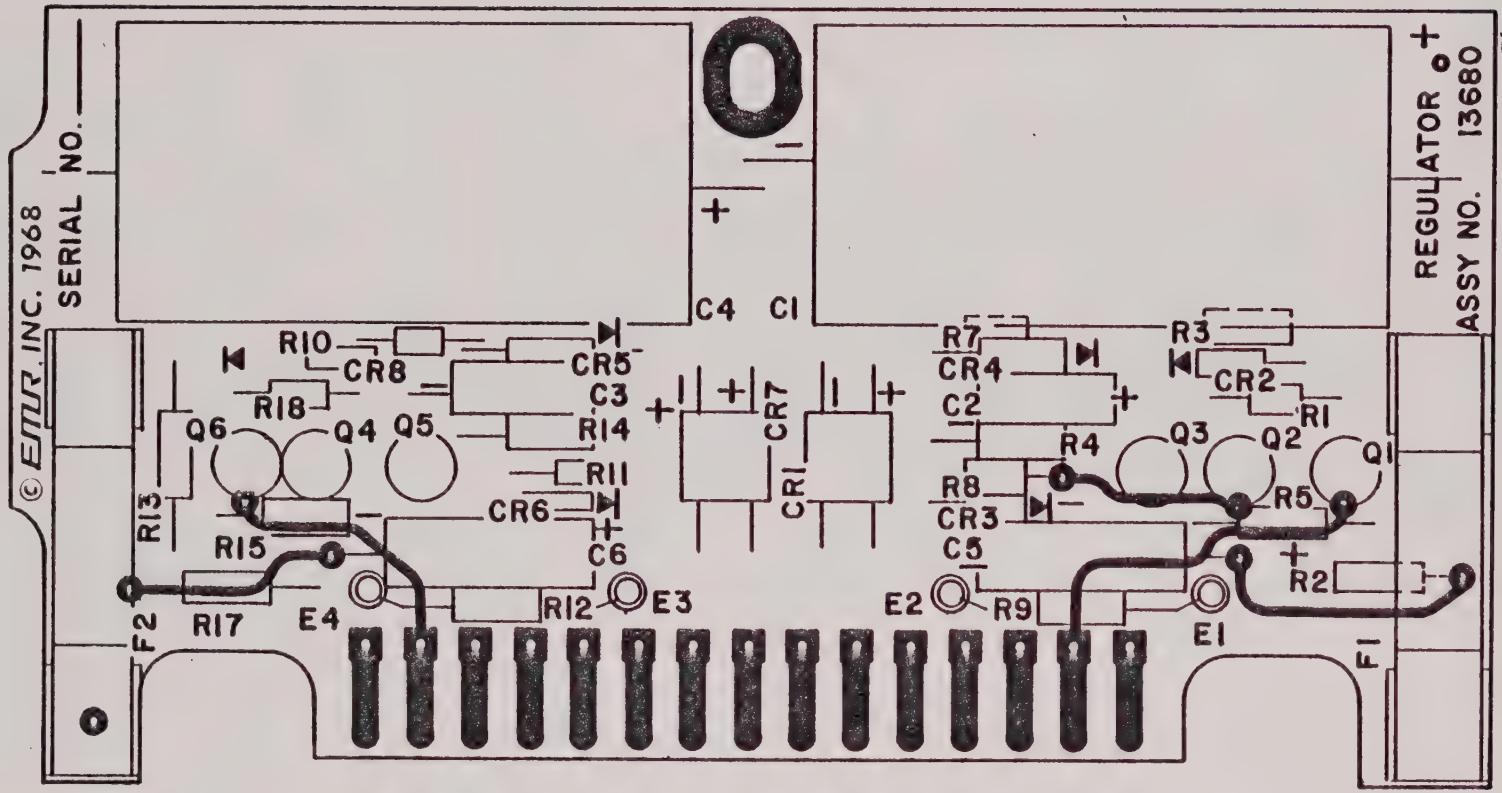
COMPONENT	PIN OR ELEMENT	VOLTAGE AND WAVEFORM
Q9	B	(Same as Q7 collector)
	C	0 volts
Q10	E	0V, −1V
	B	0V, −1V
	C	+7V, +3V
		Sine-Waves
Q11	E	−0.6V
	B	0V
	C	+5V, +3V (Sine-Wave)
Q12	E	0V
	B	−2.4V
	C	0V
Q13	E	0V
	B	+2.4V
	C	0V
Q14	E	−0.6V
	B	0V
	C	+11V

Table 5-2 (Cont'd.). Model 4581 VCO Card Assembly, Transistor Voltage Measurements and Waveforms

COMPONENT	PIN OR ELEMENT	VOLTAGE AND WAVEFORM
Q15	E	-0.6V
	B	0V
	C	+11V
Q16	E	+11.6V
	B	+11V
	C	-6V
Q17	E	-6.6V
	B	-6V
	C	(Same as Q6 emitter)
Q18	E	+12.6V
	B	+12V
	C	(Same as Q7 collector)
Q19	E	+12.5V
	B	+17.5V
	C	0V
Q28	E	-6.6V
	B	-6V
	C	+11.6V

Table 5-2 (Cont'd.). Model 4581 VCO Card Assembly, Transistor Voltage Measurements and Waveforms

COMPONENT	PIN OR ELEMENT	VOLTAGE AND WAVEFORM
TP1	—	
TP3	—	
TP4	—	



NOTE: EMR DWG. NO. 13680

Figure 5-1. Power Supply and Regulator Card Assembly
13680 Component Location Diagram

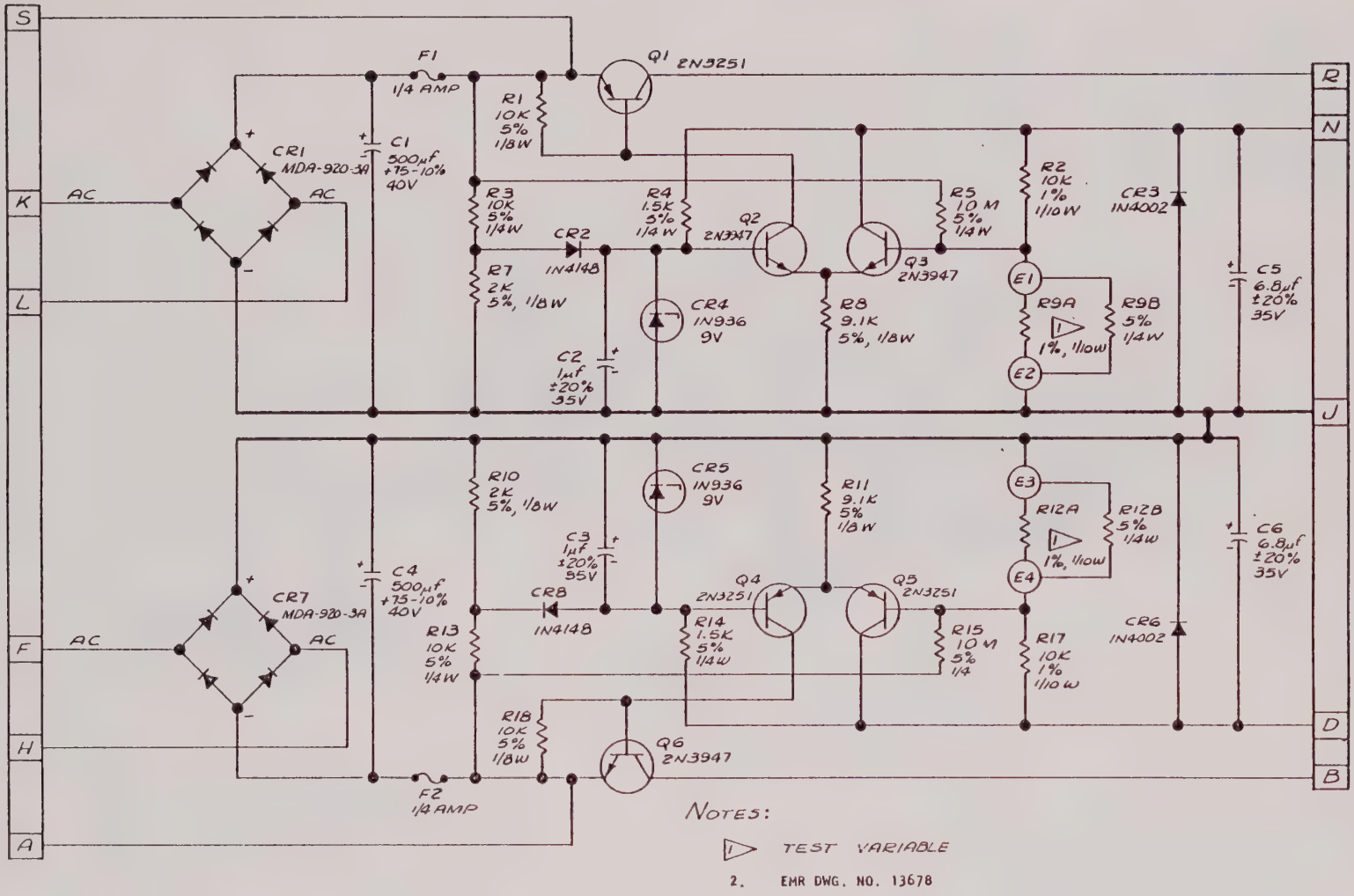


Figure 5-2. Power Supply and Regulator Card Assembly 13680
Schematic Diagram

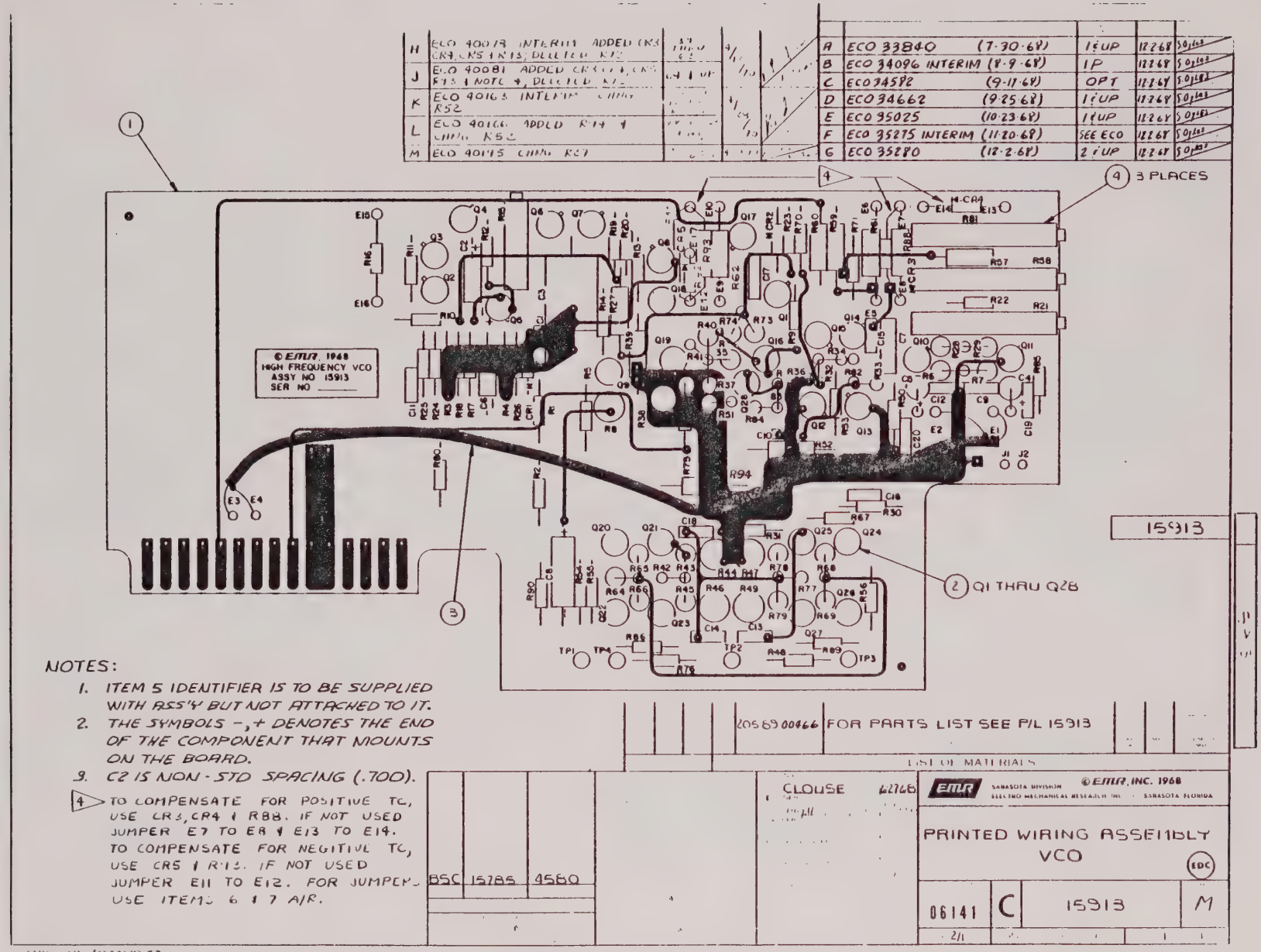

H ECO 40078 INTERIM ADDED CR3, CR4, CR5 & R15; DELETED R12
J ECO 40081 ADDED CR3, CR4, CR5, R15 & NOTE 4; DELETED R12
K ECO 40163 INTERIM CHANGE R52
L ECO 40166 ADDED R14 & CHANGE R52
M ECO 40145 CHANGE R27
A ECO 33840 (7-30-68) 1 UP 12268 50/60
B ECO 34096 INTERIM (8-9-68) 1P 12268 50/60
C ECO 34582 (9-11-68) OPT 12268 50/60
D ECO 34662 (9-25-68) 1 UP 12268 50/60
E ECO 35025 (10-23-68) 1 UP 12268 50/60
F ECO 35275 INTERIM (11-20-68) SEE ECO 12268 50/60
G ECO 35280 (12-2-68) 2 UP 12268 50/60
4 3 PLACES
© EMR, 1968
HIGH FREQUENCY VCO
ASSY NO 15913
SER NO
2 Q1 THRU Q28
3
15913
NOTES:
1. ITEM 5 IDENTIFIER IS TO BE SUPPLIED WITH ASS'Y BUT NOT ATTACHED TO IT.
2. THE SYMBOLS -, + DENOTES THE END OF THE COMPONENT THAT MOUNTS ON THE BOARD.
3. C2 IS NON-STD SPACING (.700).
4 TO COMPENSATE FOR POSITIVE TC, USE CR3, CR4 & RBB. IF NOT USED JUMPER E7 TO E8 & E13 TO E14. TO COMPENSATE FOR NEGITIVE TC, USE CR5 & R15. IF NOT USED JUMPER E11 TO E12. FOR JUMPERS USE ITEMS 6 & 7 A/R.
20569 00466 FOR PARTS LIST SEE P/L 15913
LIST OF MATERIALS
CLOUSE 12268
EMR SARASOTA DIVISION SELECTRO MECHANICAL RESEARCH INC. SARASOTA FLORIDA ©EMR, INC. 1968
PRINTED WIRING ASSEMBLY
VCO
EDC
BSC 15285 4560
06141 C 15913 M

Figure 5-3. Model 4581 VCO Card (Assembly 15913)
Component Location Diagram

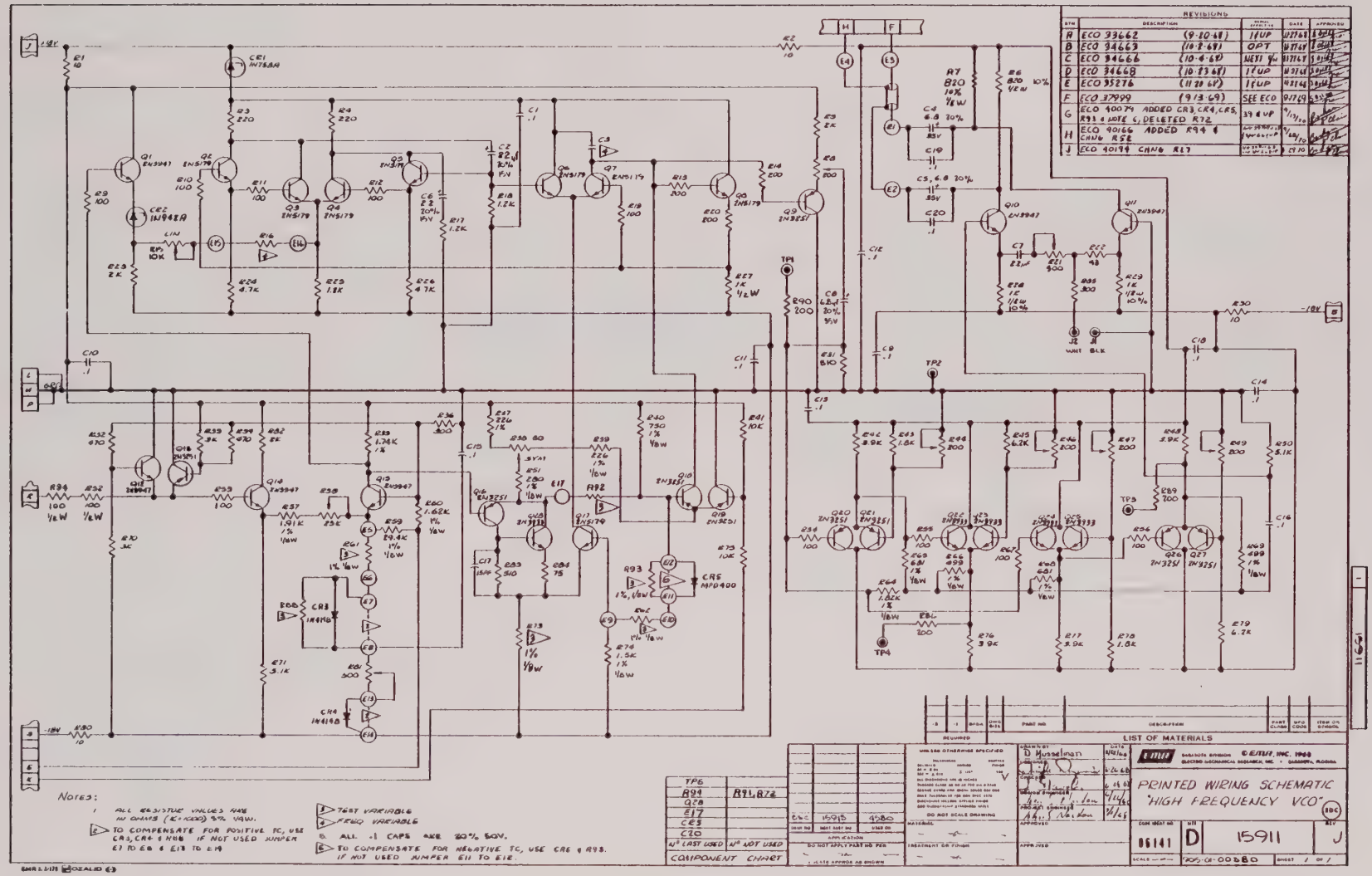


Figure 5-4. Model 4581 VCO Card (Assembly 15915)
Schematic Diagram

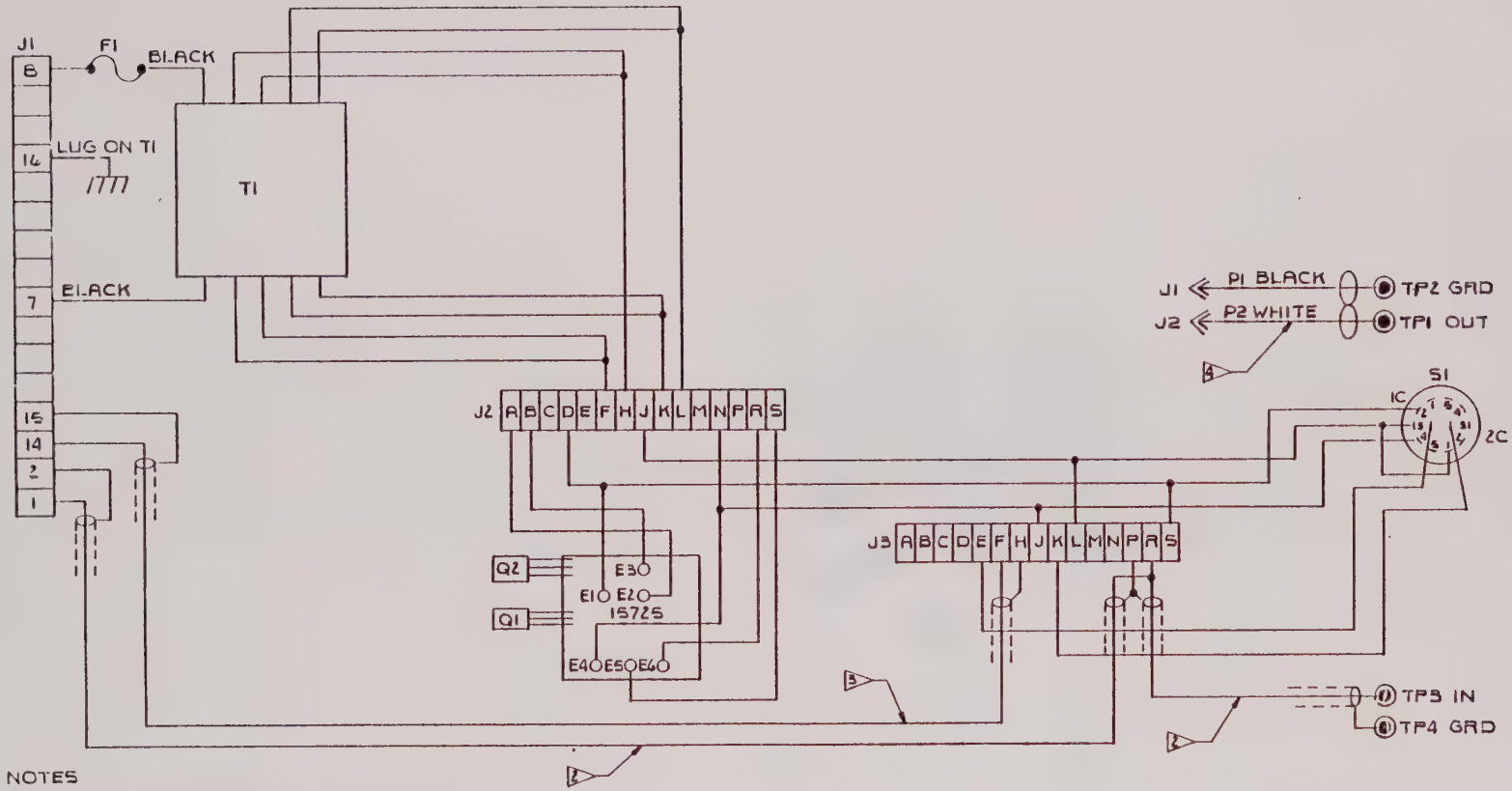
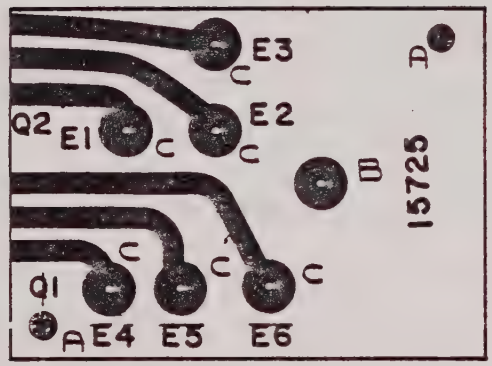


Figure 5-5. Model 4580 Wiring Diagram



NOTE: EMR DWG. NO. 15725

Figure 5-6. Transistor Board Assembly

SECTION 6

REPLACEABLE PARTS LIST AND RECOMMENDED SPARES

6.1 GENERAL

This section contains a tabular listing, (Table 6-1) by major assembly, of electrical and mechanical parts in the Model 4580 High-Frequency Voltage-Controlled Oscillator. A detailed component listing of each printed-wiring assembly (card) in the unit is included in Tables 6-2 and 6-3.

Each major assembly in the DESCRIPTION column of Table 6-1 is identified by assembly number. (The physical location of each major assembly is shown in Figure 1-2.) Other columns in Table 6-1 include EMR Stock Number, Manufacturer's Code (identified in Table 6-4), Manufacturer's Part Number, Total Quantity (TQ) used in the unit, and Recommended Spares (RS). The recommended spares as listed in Table 6-1 are based on the following listed conditions: (Paragraph 6.2 describes various other considerations for use as an aid in determining individual provisioning requirements.)

1. Operating time -- 8 hours/day, 5 days/week (2080 hours/year).

2. Operating temperature -- 0°C to 30°C.

3. User has capability to repair to the component level.

4. Failure rates are constant.

5. A 0.9 probability of being able to repair from the recommended complement for one year.

6. Equipment will be used as ground equipment (as opposed to vehicular or airborne).

6.2 PROVISIONING CONSIDERATIONS

The selection of an optimum spare parts complement involves a number of considerations known only to the user. These considerations include operating time and cycles, operating environment, number of equipment to be spared and their locations with respect to one another, urgency of returning an equipment to service, trouble-shooting, repair and test capability, stock of commonly used parts, etc.

Sparing considerations known to EMR include mean-time-between-failures for parts and assemblies under various operating environments, prices, relative ease of trouble-shooting, repair, retest, etc.

Table 6-5 lists the type of information required in order for EMR to recommend an optimum spare parts complement for specific operating and logistic situations.

If the information outlined in Table 6-5 is supplied to EMR, a recommended list will be furnished at no cost for each individual situation.

6.3 ORDERING INSTRUCTIONS

When ordering parts, complete description of each part as listed in DESCRIPTION column of parts list must accompany order. Also included, must be the EMR stock number and manufacturer's name and part number.

Table 6-1. Model 4580 High-Frequency Voltage-Controlled Oscillator Parts List (Ref. Figure 1-2)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	MODEL 4580 HIGH-FREQUENCY VOLTAGE-CONTROLLED OSCILLATOR	184-89-00036	06141	15785			
	CHASSIS ASSEMBLY	042-89-00094	06141	16274	1		
F1	FUSE, MICRO, 1/2 Amp, 125V	120-98-00037	75915	273.500	1		
J1	REAR CONNECTOR	063-98-00042	02660	26-159-16	1		
J2 and J3	CARD CONNECTOR	063-98-00046	71785	250-15-30-171	2		
Q1	TRANSISTOR	263-10-49210	JEDEC	2N4921	1		
Q2	TRANSISTOR	263-10-49180	JEDEC	2N4918	1		
S1	SWITCH, Rotary	250-89-00020	06141	8009-1	1		
T1	TRANSFORMER	262-99-00067	06141	15893	1		
XF1	FUSE HOLDER	134-98-00016	75915	281002	1		
	FRONT PANEL ASSEMBLY	191-89-00256	06141	16279	1		
TP1 thru TP4	TEST JACK	143-98-00006	98291	SKT-8-WHITE	4		
	POWER SUPPLY AND REGULATOR CARD ASSEMBLY (See Table 6-2 for breakdown)	205-89-00392	06141	13680	1		
	VCO CARD ASSEMBLY (See Table 6-3 for breakdown)	205-89-00466	06141	15913	1		

Table 6-2. Regulator Card Parts List (Ref. Figure 5-1)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	REGULATOR CARD ASSEMBLY	205-89-00392	06141	13680 (Rev.C)	1		
C1	CAPACITOR, 500 Mf -10% +75%, 40V	354-63-50005	56289	39D507G-040GJ4	2		
C2 & C3	CAPACITOR, 1.0 Mf ±20%, 35V	336-23-10003	06141	601	2		
C4	Same as C1						
C5 & C6	CAPACITOR, 6.8 Mf ±20%, 35V	337-23-68003	06141	601	2		
CR1	DIODE	214-98-00003	04713	MDA920A-3	2		
CR2	DIODE	088-10-41480	JEDEC	1N4148	2		
CR3	DIODE	088-10-40020	JEDEC	1N4002	2		
CR4 & CR5	DIODE, 9.0V, Ref. Diode	088-10-09360	JEDEC	1N936	2		
CR6	Same as CR3						
CR7	Same as CR1						
CR8	Same as CR2						
F1 & F2	FUSE, Slo-Blo, 1/2 Amp	120-98-00019	75915	313.500	2		
Q1	TRANSISTOR	263-10-32510	JEDEC	2N3251	2		
Q2 & Q3	TRANSISTOR	263-10-39470	JEDEC	2N3947	3		
Q4 & Q5	Same as Q1						
Q6	Same as Q2						
R1	RESISTOR, 10K ±5%, 1/8W	620-02-10001	01121	RC05GF103J	2		
R2	RESISTOR, 10K ±1%, 1/10W	608-09-10001	06141	624	2		
R3	RESISTOR, 10K ±5%, 1/4W	616-02-10001	01121	RC07GF103J	2		
R4	RESISTOR, 1.5K ±5%, 1/4W	616-02-15000	01121	RC07GF152J	2		
R5	RESISTOR, 10 Meg ±5%, 1/4W	616-02-10004	01121	RC07GF106J	2		
R7	RESISTOR, 2K ±5%, 1/8W	620-02-20000	01121	RC05GF202J	2		
R8	RESISTOR, 9.1K ±5%, 1/8W	620-02-91000	01121	RC05GF912J	2		
R9A	RESISTOR, Test Variable, ±1%, 1/8W	608-09-00000	06141	625	2		
R9B	RESISTOR, Test Variable, ±5%, 1/4W	616-02-00000	06141		2		
R10	Same as R7						
R11	Same as R8						
R12A	Same as R9A						
R12B	Same as R9B						
R13	Same as R3						

Table 6-2 (Cont'd.). Regulator Card Parts List (Ref. Figure 5-1)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
R14	Same as R4						
R15	Same as R5						
R17	Same as R2						
R18	Same as R1						

Table 6-3. Model 4581 VCO Card Assembly Parts List (Ref. Figure 5-3)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
	MODEL 4581 VCO CARD ASSEMBLY	205-89-00466	06141	15913 (Rev.M)	1		
C1	CAPACITOR, 0.1 Mf ±20%, 50V, LS.200	301-13-10002	72982	8131-050-651-104M	12	1	
C2	CAPACITOR, 22 Mf ±20%, 15V	337-21-22004	06141	601	1		
C3	CAPACITOR, Frequency Variable	999-01-00001	06141	16292	1		
C4 & C5	CAPACITOR, 6.8 Mf ±20%, 35V	337-23-68003	06141	601	3		
C6	CAPACITOR, 2.2 Mf ±20%, 15V	336-21-22003	06141	601	1		
C7	CAPACITOR, 2.2 Mf ±20%, 25V	386-03-22003	56289	5C023225-X0250B3	1		
C8	Same as C4						
C9 thru C16	Same as C1						
C17	CAPACITOR, 15 Pf ±0.5 Pf, 500V	304-01-01509	06141	600	1		
C18 thru C20	Same as C1						
CR1	DIODE	088-99-00259	06141	642-12	1		
CR2	DIODE	088-10-09421	JEDEC	1N942A	1		
CR3 & CR4	DIODE	088-10-41480	JEDEC	1N4148	2		
CR5	DIODE	088-19-00029	08806	MPD400	1		
J1 & J2	SOCKET, Cont., Funnel-type	065-98-00013	15849	7706	2		
Q1	TRANSISTOR	263-10-39470	JEDEC	2N3947	6		
Q2 thru Q8	TRANSISTOR	263-10-51790	JEDEC	2N5179	8		
Q9	TRANSISTOR	263-10-32510	JEDEC	2N3251	9	1	
Q10 thru Q12	Same as Q1						
Q13	Same as Q9						
Q14 & Q15	Same as Q1						
Q16	Same as Q9						
Q17	Same as Q2						
Q18 thru Q21	Same as Q9						
Q22 thru Q25	TRANSISTOR, NPN, VHF/UHF Ampl.	263-10-39330	JEDEC	2N3933	5		

Table 6-3 (Cont'd.). Model 4581 VCO Card Assembly Parts List (Ref. Figure 5-3)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
Q26 & Q27	Same as Q9						
Q28	Same as Q22						
R1 & R2	RESISTOR, 10 ohms ±5%, 1/4W	616-02-01009	01121	RC07GF100J	4		
R3 & R4	RESISTOR, 220 ohms ±5%, 1/4W	616-02-22009	01121	RC07GF221J	2		
R5	RESISTOR, 2K ±5%, 1/4W	616-02-20000	01121	RC07GF202J	3		
R6 & R7	RESISTOR, 820 ohms ±10%, 1/2W	622-03-82009	01121	RC20GF821K	2		
R8	POTENTIOMETER, 200 ohms ±30%, 1/2W	201-98-00062	73138	62PR200	5		
R9 thru R12	RESISTOR, 100 ohms ±5%, 1/4W	616-02-10009	01121	RC07GF101J	10	1	
R13 & R14	RESISTOR, 200 ohms ±5%, 1/4W	616-02-20009	01121	RC07GF201J	7	1	
R15	POTENTIOMETER, 10K ±10%, 3/4W	201-98-00148	73138	79PR10K	1		
R16	RESISTOR, Frequency variable	999-01-00002	06141	16292	1		
R17 & R18	RESISTOR, 1.2K ±5%, 1/4W	616-02-12000	01121	RC07GF122J	2		
R19	Same as R9						
R20	Same as R13						
R21	POTENTIOMETER, 500 ohms ±20%, 3/4W	201-98-00155	73138	78PR500	2		
R22	RESISTOR, 43 ohms ±5%, 1/4W	616-02-04309	01121	RC07GF430J	1		
R23	Same as R5						
R24	RESISTOR, 4.7K ±5%, 1/4W	616-02-47000	01121	RC07GF472J	2		
R25	RESISTOR, 1.2K ±5%, 1/4W	616-02-12000	01121	RC07GF122J	1		
R26	Same as R24						
R27	RESISTOR, 1K ±5%, 1/4W	616-02-10000	01121	RC07GF102J	1		
R28 & R29	RESISTOR, 1K ±10%, 1/2W	622-03-10000	01121	RC20GF102K	2		
R30	Same as R1						
R31	RESISTOR, 510 ohms ±5%, 1/4W	616-02-51009	01121	RC07GF511J	2		
R32	RESISTOR, 470 ohms ±5%, 1/4W	616-02-47009	01121	RC07GF471J	2		
R33	RESISTOR, 3K ±5%, 1/4W	616-02-30000	01121	RC07GF302J	1		
R34	Same as R32						
R35	RESISTOR, 1.74K ±1%, 1/8W	605-09-17400	06141	625	1		
R36	RESISTOR, 300 ohms ±5%, 1/4W	616-02-30009	01121	RC07GF301J	2		
R37	RESISTOR, 226 ohms ±1%, 1/8W	605-09-22609	06141	625	2		
R38	POTENTIOMETER, 50 ohms ±30%, 1/2W	201-98-00068	73138	62PR50	1		

Table 6-3 (Cont'd.). Model 4581 VCO Card Assembly Parts List (Ref. Figure 5-3)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
R39	Same as R37						
R40	RESISTOR, 750 ohms ±1%, 1/8W	605-09-75009	06141	625	1		
R41	RESISTOR, 10K ±5%, 1/4W	616-02-10001	01121	RC07GF103J	2		
R42	RESISTOR, 3.9K ±5%, 1/4W	616-02-39000	01121	RC07GF392J	4		
R43	RESISTOR, 1.8K ±5%, 1/4W	616-02-18000	01121	RC07GF182J	2		
R44	Same as R8						
R45	RESISTOR, 6.2K ±5%, 1/4W	616-02-62000	01121	RC07GF622J	2		
R46 & R47	Same as R8						
R48	Same as R42						
R49	Same as R8						
R50	RESISTOR, 5.1K ±5%, 1/4W	616-02-51000	01121	RC07GF512J	2		
R51	RESISTOR, 280 ohms ±1%, 1/8W	605-09-28009	06141	625	1		
R52	Same as R13						
R53 thru R56	Same as R9						
R57	RESISTOR, 1.91K ±1%, 1/8W	605-09-19100	06141	625	1		
R58	POTENTIOMETER, 25K ±20%, 3/4W	201-98-00154	73138	78PR25K	1		
R59	RESISTOR, 29.4K ±1%, 1/8W	605-09-29401	06141	625	1		
R60	RESISTOR, 1.62K ±1%, 1/8W	605-09-16200	06141	625	1		
R61 & R62	RESISTOR, Test variable, ±1%, 1/8W	605-09-00000	06141	625	4		
R64	RESISTOR, 1.82K ±1%, 1/8W	605-09-18200	06141	625	1		
R65	RESISTOR, 681 ohms ±1%, 1/8W	605-09-68109	06141	625	1		
R66	RESISTOR, 499 ohms ±1%, 1/8W	605-09-49909	06141	625	2		
R67	Same as R9						
R68	RESISTOR, 681 ohms ±1%, 1/8W	605-09-68109	06141	625	1		
R69	Same as R66						
R70	RESISTOR, 3K ±5%, 1/4W	616-02-30000	01121	RC07GF302J	1		
R71	Same as R50						
R73	Same as R61						
R74	RESISTOR, 1.5K ±1%, 1/8W	605-09-15000	06141	625	1		
R75	Same as R41						
R76 & R77	Same as R42						
R78	Same as R43						

Table 6-3 (Cont'd.). Model 4581 VCO Card Assembly Parts List (Ref. Figure 5-3)

REF. DESIG.	DESCRIPTION	EMR STOCK NO.	MFGR. CODE	MFGR. PART NO.	TQ	RS	UNIT PRICE
R79	Same as R45						
R80	Same as R1						
R81	Same as R21						
R82	Same as R5						
R83	Same as R31						
R84	RESISTOR, 75 ohms ±5%, 1/4W	616-02-07509	01121	RC07GF750J	1		
R85	Same as R36						
R86	Same as R13						
R88	RESISTOR, Test variable	605-09-00000	06141		1		
R89 & R90	Same as R13						
R92	RESISTOR, Test variable	620-02-00000	06141	625	1		
R93	Same as R61						
TP1	TEST JACK, White	143-98-00023	74970	105-851	3		
TP2	TEST JACK, Black	143-98-00010	74970	105-853	1		
TP3 & TP4	Same as TP1						

TABLE 6-4. MANUFACTURERS' NAMES AND CODE NUMBERS

MFR'S CODE	MFR'S NAME AND ADDRESS
00222	E. S. C. Electronics Corp., Palisades Park, N. J.
00779	Amp, Inc., Harrisburg, Pa.
01121	Allen-Bradley Co., Milwaukee, Wis.
01295	Texas Instrument, Inc., Semiconductor Components Div., Dallas, Texas
01686	RCL Electronics, Manchester, N. H.
02111	Spectrol Electronics Corp., City of Industry, Calif.
02660	Amphenol Corp., Broadview, Ill.
02735	Radio Corp. of America, (RCA) Somerville, N. J.
02985	Tepco Electric Corp., Rochester, N. Y.
03797	Eldema Corp., Compton, Calif.
03855	Ecco Electronic Components Corp., Mt. Vernon, N. Y.
04713	Motorola Semiconductor Products, Inc., Phoenix, Ariz.
05170	Engineered Electronics Co., Inc., Santa Ana, Calif.
06141	Electro-Mechanical Research, Inc., Sarasota, Fla.
06540	Amathom Electronic Hdwr. Co., Inc., New Rochelle, N. Y.
07137	Transistor Electronics Corp., Minneapolis, Minn.
07263	Fairchild Camera and Instrument Corp., Mountain View, Calif.
07716	IRC, Inc., Burlington, Iowa
08806	General Electric Co., Miniature Lamp Dept., Cleveland, Ohio
09145	Atohm Electronics, Burbank, California
09353	C and K Components, Inc., Newton, Mass.
09922	Burndy Corp., Norwalk, Conn.

TABLE 6-4. MANUFACTURERS' NAMES AND CODE NUMBERS (CONT'D)

MFR'S CODE	MFR'S NAME AND ADDRESS
11139	Deutsch Co. Electronic Components Div., Banning, Calif.
12040	National Semiconductor, Danbury, Conn.
12697	Clarostat Mfg. Co., Inc., Dover, N. H.
12954	Dickson Electronics Corp., Scottsdale, Ariz.
13511	Amphenol Corp., Los Gatos, Calif.
14655	Cornell-Dubilier Electric Corp., Newark, N. J.
14749	Acopian Corp., Easton, Pa.
14752	Electro Cube, Inc., Pasadena, Calif.
15849	Useco, Inc., Mt. Vernon, N. Y.
15915	Tepro of Florida, Inc., Dunedin, Florida
17276	Nexus Research Lab, Dedham, Mass.
19701	Electra Mfg. Co., Independence, Kansas
22229	Union Carbide, Mountain View, Calif.
25244	Centralab Div., Globe-Union, Milwaukee, Wis.
56289	Sprague Electric Co., North Adams, Mass.
58474	Superior Electric Corp., Bristol, Conn.
71450	CTS Corp., Elkhart, Ind.
71468	Cannon Electric Co., Los Angeles, Calif.
71744	Chicago Miniature Lamp Works, Chicago, Ill.
71785	Cinch Mfg. Co., Chicago, Ill.
72619	Dialight Corp., Brooklyn, N. Y.
72982	Erie Technological Products, Inc., Erie, Pa.
73138	Beckman Instruments, Inc., Fullerton, Calif.

TABLE 6-4. MANUFACTURERS' NAMES AND CODE NUMBERS (CONT'D)

MFR'S CODE	MFR'S NAME AND ADDRESS
73582	Kulka Corp., Mt. Vernon, New York
73705	Electronic Products, Inc., Cleveland, Ohio
74545	Harvey Hubbel, Inc., Bridgeport, Conn.
74970	E. F. Johnson Co., Waseca, Minn.
75915	Littelfuse, Inc., Des Plaines, Ill.
78769	E. H. Titchener and Co., Binghampton, N. Y.
80294	Bourns, Inc., Riverside, Calif.
81030	International Instruments Inc., Orange, Conn.
81073	Grayhill, Inc., La Grange, Ill.
G81349	Military Specifications Promulgated by Standardization Div. Directorate of Logistic Services DSA
81590	Korry Mfg. Co., Seattle, Wash.
83594	Burroughs Corp., Plainfield, N. J.
84171	Arco Electronics, Inc., Great Neck, N. Y.
85604	Kepco, Inc., Flushing, New York
90201	Mallory Capacitor Co., Indianapolis, Ind.
91506	Augat, Inc., Attleboro, Mass.
91737	Gremar Mfg. Co., Inc., Wakefield, Mass.
93332	Sylvania Electric Prod., Inc., Semiconductor Div., Woburn, Mass.
94412	Dressen Barnes Electronic Corp., Pasadena, Calif.
95073	Douglas Randall, Inc., Westerly, R. I.
95275	Vitramon, Inc., Bridgeport, Conn.
95692	Artisan Electronics Corp., Parisppany, N. J.

TABLE 6-4. MANUFACTURERS' NAMES AND CODE NUMBERS (CONT'D)

MFR'S CODE	MFR'S NAME AND ADDRESS
96602	Dale Electronics, Inc., Columbus, Neb.
97564	Clare-Pendar, Inc., Post Falls, Idaho
98291	Sealectro Corp., Mamaroneck, N. Y.

Table 6-5. Customer Provisioning Questionnaire

1.	Equipment to be spared Model No.(s):_____ Serial No.(s):_____
2.	Number of equipments to be spared in each location_____
3.	Operating time and cycle:_____hours/day,_____days/week.
4.	Operating Environment: A. Temperature:_____ B. Humidity:_____ C. Altitude:_____ D. Shock and Vibration:_____
5.	Non-operating Environment:_____ A. Temperature:_____ B. Humidity:_____ C. Altitude:_____
6.	Desired probability of being able to spare from complement _____percent for_____months.
7.	Can usage permit troubleshooting to parts level when a failure occurs?_____
8.	What spare assemblies do you have that are used in this Model Equipment?_____
9.	Do you wish us to exclude the EMR warranty period?_____

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